

REMARKS

Applicants request favorable reconsideration and allowance of the subject application in view of the preceding amendments and the following remarks.

Claims 1-12 are presented for consideration. Claims 1 and 11 are independent. Claims 1, 3 and 11 have been amended to clarify features of the subject invention. Support for these changes can be in the original application, as filed. For example, the Examiner's attention is directed to the tilt portion 17 and closing portion 12a, as shown in Figure 1, as well as the inhibition function, which is discussed in the subject specification on page 11, line 25, to page 12, line 9, and the changes to claim 3, namely, that the shielding portion and the cooling portion are integral, which are discussed on page 12, lines 17-19. Accordingly, no new matter has been added.

Applicants request favorable reconsideration and withdrawal of the rejections set forth in the above-noted Office Action.

Claims 1, 4 and 10-12 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 5,854,490 to Ooah et al. in view of U.S. Patent No. 3,634,645 to Lempert et al. and U.S. Patent No. 5,633,507 to Pfeiffer et al. Claim 2 was rejected under 35 U.S.C. § 103 based on the original art combination and further in view of U.S. Patent No. 4,199,689 to Takagawa. Claim 3 was rejected under 35 U.S.C. § 103 as being unpatentable over the original art combination and further in view of U.S. Patent No. 4,467,205 to Beisswenger et al. Claims 5 and 6 were rejected under 35 U.S.C. § 103 as being unpatentable over a combination of the Ooah et al., Lempert et al., Pfeiffer et al. and Beisswenger et al. patents, as applied to claim 3

above, and further in view of U.S. Patent No. 5,136,171 to Leung et al. Claims 7 and 8 were rejected under 35 U.S.C. § 103 as being unpatentable over the original art combination and further in view of U.S. patent application publication number 2003/0189180 to Hamaguchi et al. Claim 9 was rejected under 35 U.S.C. § 103 as being unpatentable over the combination of the Ooaeh et al., Lempert et al., Pfeiffer et al. and Hamaguchi et al. patents as applied to claims 7 and 8 above, and further in view of the Beisswenger et al. patent. Applicants submit that the cited art, whether taken individually or in combination, does not teach many features of the present invention, as previously recited in claims 1-12. Therefore, these rejections are respectfully traversed. Nevertheless, Applicants submit that independent claims 1 and 11, as presented, amplify the distinctions between the present invention and the cited art.

In one aspect of the present invention, independent claim 1 recites an electron gun including a cathode portion which emits electrons, an anode portion which has an aperture and accelerates the emission electrons, a bias portion which is arranged between the cathode portion and the anode portion and controls trajectories of the emission electrons, a shielding portion which is arranged below the anode portion and shields some of the emission electrons, and a cooling portion which cools the shielding portion. The shielding portion includes a tilt portion tilting with respect to an incident direction of the emission electrons becoming incident on the shielding portion, and includes a closing portion located between the tilt portion and the anode portion. The closing portion inhibits the electrons reflected by the tilt portion from passing through the aperture of the anode portion.

In another aspect of the present invention, independent claim 11 recites an electron beam exposure apparatus including an electron gun that includes a cathode portion which emits electrons, an anode portion which has an aperture and accelerates the emission electrons, a bias portion which is arranged between the cathode portion and the anode portion and controls trajectories of the emission electrons, a shielding portion which is arranged below the anode portion and shields some of the emission electrons, and a cooling portion which cools the shielding portion, and a stage which moves in holding a substrate to be exposed by using the emission electrons. The shielding portion includes a tilt portion tilting with respect to an incident direction of the emission electrons becoming incident on the shielding portion, and includes a closing portion located between the tilt portion and the anode portion. The closing portion inhibits the electrons reflected by the tilt portion from passing through the aperture of the anode portion.

Applicants submit that the cited art, whether taken individually or in combination, does not teach or suggest such features of Applicants' present invention, as recited in independent claims 1 and 11.

The Ooach et al. patent shows a charged particle beam exposure device in which an electron gun emits an electron beam traveling along a beam axis. The electron gun has a cathode having a tip, the tip having substantially a circular conic shape and a tip surface substantially at the beam axis. A first voltage is applied to the cathode. An anode has a first aperture substantially on the beam axis to which a second voltage higher than the first voltage is applied. A control electrode has a second aperture substantially on the beam axis and a voltage lower than

the first voltage is applied to the control electrode to control a current of the cathode. The second aperture is larger than the tip surface. A guide electrode having a third aperture substantially on the beam axis is arranged between the cathode and the anode, and a voltage higher than the first voltage and lower than the second voltage is applied to the guide electrode. The third aperture is smaller than the tip surface. A lens electrode with a fourth aperture substantially on the beam axis is arranged between the guide electrode and the anode. A voltage lower than the first voltage is applied to the lens electrode to form a cross-over image of the electron beam. The fourth aperture is larger than the third aperture.

Accordingly, the Ooaeh et al. shows an electron gun which includes a cathode portion 114, an anode portion 113, a bias portion 112, and a shielding portion 411 (that is, a beam-cutting-off aperture). That patent also shows the beam-cutting-off aperture 411 having a cooling mechanism 430. Applicants submit, however, that the Ooaeh et al. patent does not teach or suggest salient features of Applicants' present invention, as recited in independent claims 1 and 11, in which a shielding portion has a closing portion inhibiting electrons reflected by a tilt portion from passing through an aperture of an anode portion. In the present invention, the shielding portion having a closing portion can prevent the electrons reflected from the tilt portion from passing through the aperture of the anode portion. Thus, the present invention can provide an electron gun used with a high voltage, which can attain a high thermal stability.

Applicants submit that the Ooaeh et al. patent does not teach or suggest such features of Applicants' present invention, as recited in independent claims 1 and 11. Applicants further

submit that the remaining art cited fails to cure the deficiencies noted above with respect to the Ooaeh et al. patent .

The Lempert et al. patent teaches that aperture damage caused by an incident electron beam can be avoided by moving a cross-over of an electron beam. The Pfeiffer et al. patent teaches a typical triode gun forming a cross-over 7 between a bias electrode 3 and an anode 5. The Beisswenger et al. patent teaches an anode electrode having a tilt portion and an aperture, that is, a Faraday cage FK. (Applicants submit, however, that the Beisswenger et al. patent, for example, does not solve problems about thermal stability at a high voltage, and the striking electrons, because the electrons in that patent directly strike the anode.) The Examiner relies on the Takagawa patent for teaching an electron beam with a highly controllable diameter at a beam cross-over point, which is formed using a cathode (emitter) having a hemispherical (that is, rounded) top surface. The Examiner relies on the Leung et al. patent for teaching that when a cooling portion is used with a Faraday cage (210) to measure the current of an electron beam, it must include an insulator and de-ionized water, which should be passed through the cooling portion. The Examiner relies on the Hamaguchi et al. publication for teaching that a plurality of electron guns can be provided in a single chamber and that additional electrodes (slit-deflecting unit 15) to which voltages are applied can be provided between the anode 13 and the shielding portions (slit covers 11).

Applicants submit that these remaining citations do not teach or suggest the salient features of Applicants' present invention, as recited in independent claims 1 and 11, which have been discussed above. Namely, that art does not teach or suggest a shielding portion having a

closing portion inhibiting electrons reflected by a tilt portion from passing through an aperture of an anode portion. Accordingly, the remaining art cited adds nothing to the teachings of the Ooaeh et al. patent that would render obvious Applicants' present invention, as recited in independent claims 1 and 11.

For the foregoing reasons, Applicants submit that the present invention, as recited in independent claims 1 and 11, is patentably defined over the cited art, whether that art is taken individually or in combination.

Dependent claims 2-10 and 12 also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in their respective independent claims. Further individual consideration of these dependent claims is requested.

Applicants further submit that this Amendment After Final Rejection places this application in condition for allowance. This Amendment was not earlier presented because Applicants believed that the prior Amendment placed the application in condition for allowance. Accordingly, entry of the instant Amendment, as an earnest attempt to advance prosecution and reduce the number of issues, is requested under 37 CFR 1.116.

Favorable reconsideration, withdrawal of the rejections set forth in the above-noted Office Action and an early Notice of Allowance are also requested.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010 All correspondence should continue to be directed to our address given below.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Steven E. Warner", is written over a horizontal line.

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